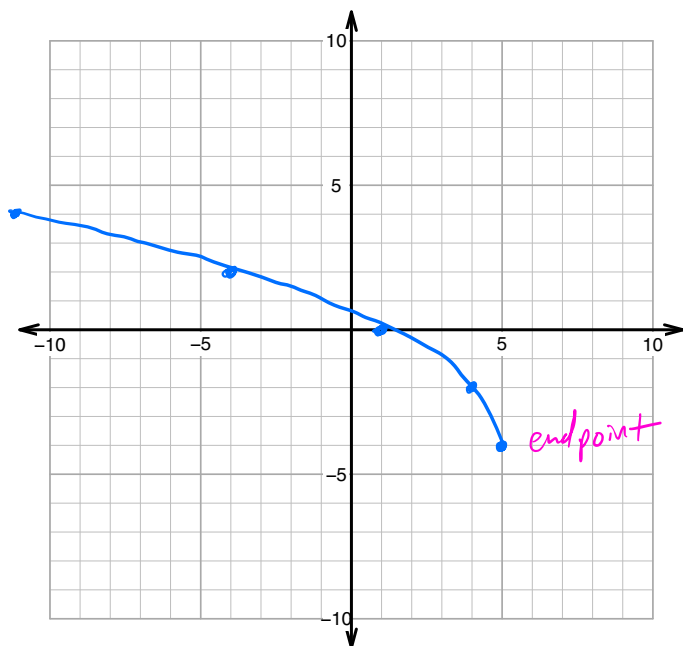# PCW_1015: Parent Transformations and Feature Locations

1. Make an accurate graph, and describe locations of the features (using interval notation, line equations, and Cartesian coordinates).

$$y = 2 \cdot \sqrt{5-x} - 4$$

parent: $b = \sqrt{a}$

a	b
0	0
1	1
4	2
9	3
16	4

endpoint

no asymptotes

Replace $5-x$ w/ a
$$y = 2 \cdot \sqrt{a} - 4$$

Replace $\sqrt{a}$ w/ b
$$\boxed{y = 2b - 4}$$

Use $x = 5-a$
and
$$y = 2b-4$$

x	y
5	-4	endpoint
4	-2
1	0
-4	2
-11	4

Set argument = a
$$5 - x = a$$
$$-x = a - 5$$
$$x = -(a-5)$$
$$x = -a + 5$$
$$\boxed{x = 5-a}$$

endpoint

$$y_{int} = 2\sqrt{5-0} - 4$$
$$y_{int} = 2\sqrt{5} - 4$$
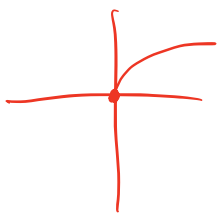
Feature	Where
Domain (x interval)	$(-\infty, 5]$
Range (y interval)	$[-4, \infty)$
Positive (x interval)	$(-\infty, 1)$
Negative (x interval)	$(1, 5)$
Increasing (x interval)	$\emptyset$
Decreasing (x interval)	$(-\infty, 5)$
Asymptote(s) (line equations)	$\emptyset$
Intercept(s) (coordinates)	$(1,0)$ and $(0, 2\sqrt{5}-4)$

↑ sorry... approx $(0, 0.5)$

2. Make an accurate graph, and describe locations of the features (using interval notation, line equations, and Cartesian coordinates).
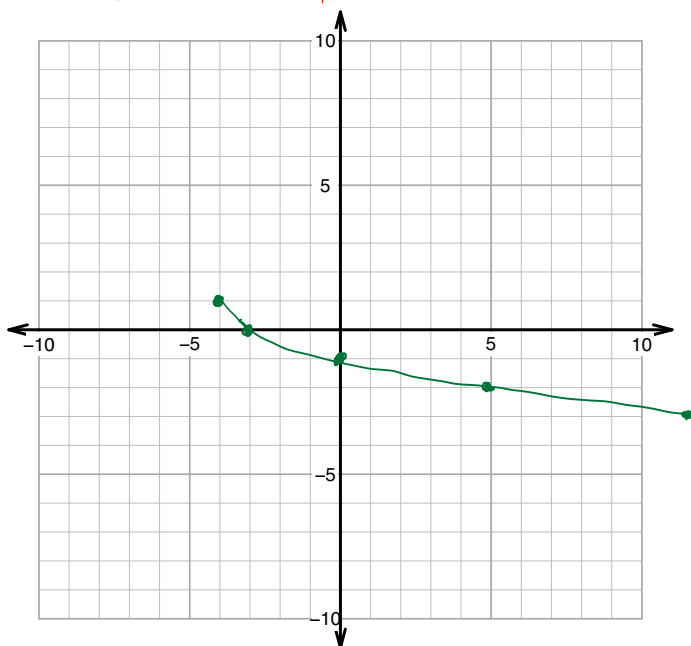
parent: $b = \sqrt{a}$

a	b
0	0
1	1
4	2
9	3
16	4

$$y = -\sqrt{x+4} + 1$$

$x + 4 = a$

$$\boxed{x = a - 4}$$

$y = -\sqrt{a} + 1$

$$\boxed{y = -b + 1}$$

x	y
-4	1
-3	0
0	-1
5	-2
12	-3

Feature	Where
Domain (x interval)	$[-4, \infty)$
Range (y interval)	$(-\infty, 1]$
Positive (x interval)	$[-4, -3)$
Negative (x interval)	$(3, \infty)$
Increasing (x interval)	$\emptyset$
Decreasing (x interval)	$(-4, \infty)$
Asymptote(s) (line equations)	$\emptyset$
Intercept(s) (coordinates)	$(-3, 0)$ and $(0, -1)$

2

3. Make an accurate graph, and describe locations of the features (using interval notation, line equations, and Cartesian coordinates).

parent: $b = a^2$
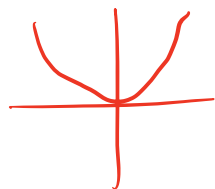
a	b
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$$y = -\left(\frac{x}{3} + 1\right)^2 + 4$$

$$\frac{x}{3} + 1 = a$$

$$\frac{x}{3} = a - 1$$
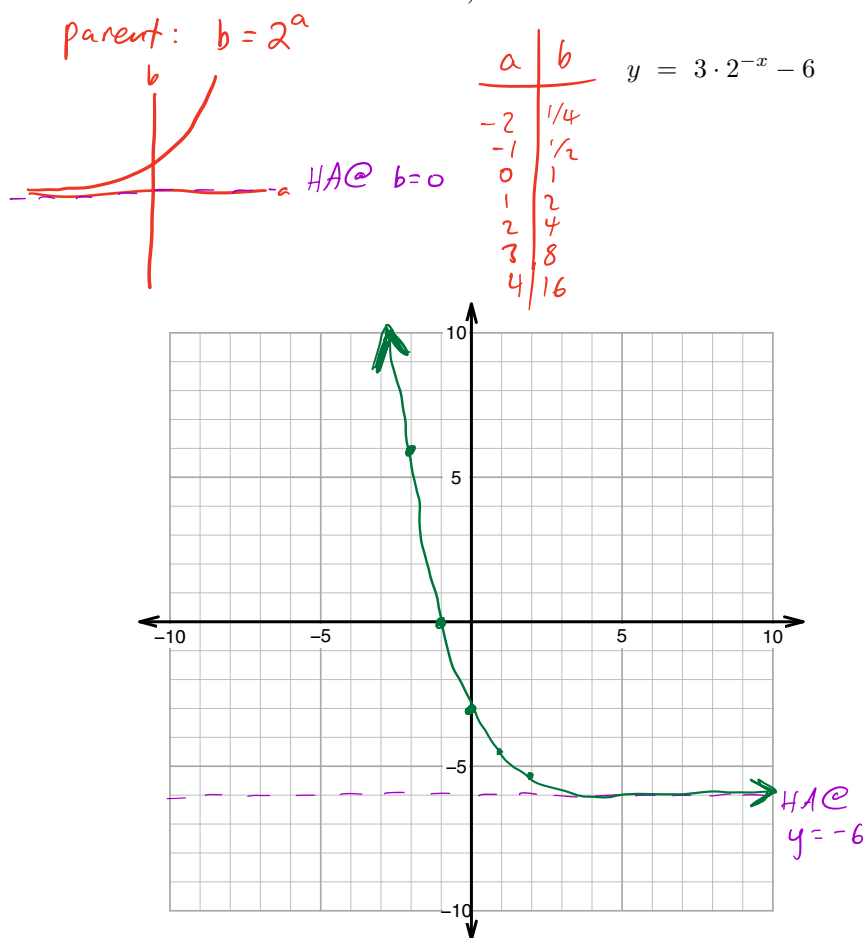
$$\boxed{x = 3 \cdot (a - 1)}$$

$$y = -(a)^2 + 4$$

$$\boxed{y = -b + 4}$$
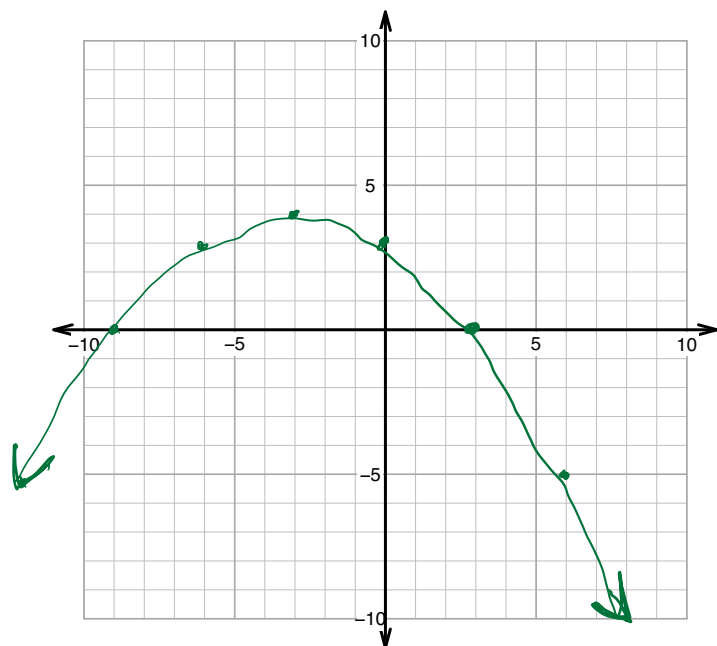
x	y
-12	-5
-9	0
-6	3
-3	4
0	3
3	0
6	-5

Feature	Where
Domain (x interval)	$(-\infty, \infty)$
Range (y interval)	$(-\infty, 4]$
Positive (x interval)	$(-9, 3)$
Negative (x interval)	$(-\infty, -9) \cup (3, \infty)$
Increasing (x interval)	$(-\infty, -3)$
Decreasing (x interval)	$(-3, \infty)$
Asymptote(s) (line equations)	$\emptyset$
Intercept(s) (coordinates)	$(-9, 0)$ and $(0, 3)$ and $(3, 0)$

3

4. Make an accurate graph, and describe locations of the features (using interval notation, line equations, and Cartesian coordinates).

parent: $b = 2^a$

HA@ b=0

a	b
-2	1/4
-1	1/2
0	1
1	2
2	4
3	8
4	16

$y = 3 \cdot 2^{-x} - 6$

$-x = a$

$x = -a$

$y = 3 \cdot 2^a - 6$

$y = 3 \cdot b - 6$

parent has horizontal asymptote @ b=0

HA

$y = 3 \cdot 0 - 6$

$y = -6$

HA

HA@ y=-6

x	y
2	3/4 - 6 = -5.25
1	3/2 - 6 = -4.5
0	-3
-1	0
-2	6
-3	22
-4	42

| Feature	Where
Domain (x interval)	$(-\infty, \infty)$
Range (y interval)	$(-6, \infty)$
Positive (x interval)	$(-\infty, -1)$
Negative (x interval)	$(-1, \infty)$
Increasing (x interval)	$\emptyset$
Decreasing (x interval)	$(-\infty, \infty)$
Asymptote(s) (line equations)	$y = -6$
Intercept(s) (coordinates)	$(-1, 0)$ and $(0, -3)$

4

5. Make an accurate graph, and describe locations of the features (using interval notation, line equations, and Cartesian coordinates).

Parent: $b = a^3$

a	b
-4	-64
-3	-27
-2	-8
-1	-1
0	0
1	1
2	8
3	27
4	64
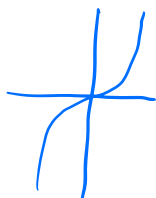
$$y = \frac{(x+4)^3}{8} - 1$$
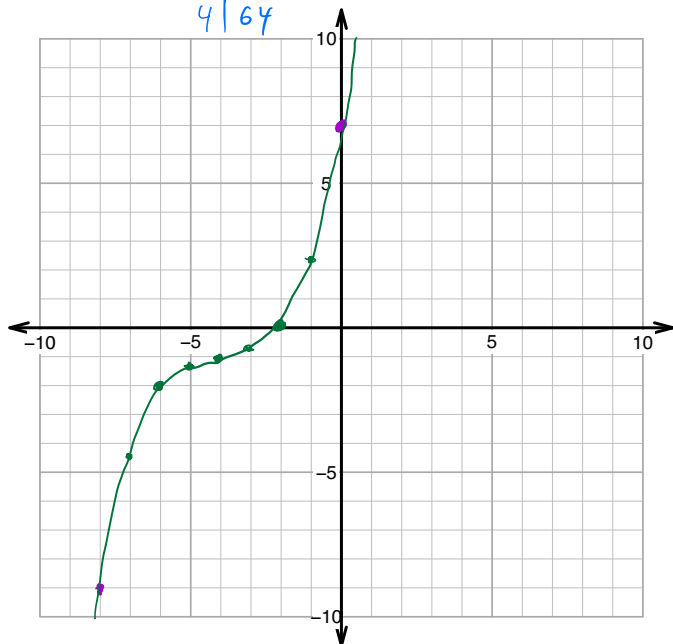
$x + 4 = a$

$$x = a - 4$$

$$y = \frac{(a)^3}{8} - 1$$

$$y = \frac{b}{8} - 1$$

x	y
-8	-9
-7	$\frac{-27}{8} - 1 = \frac{-35}{8} = -4 - \frac{3}{8} = -4.375$
-6	-2
-5	$\frac{-1}{8} - 1 = \frac{-9}{8} = -1.125$
-4	-1
-3	$\frac{1}{8} - 1 = \frac{-7}{8} = -0.875$
-2	0
-1	$\frac{27}{8} - 1 = \frac{27}{8} - \frac{8}{8} = \frac{19}{8} = \frac{16}{8} + \frac{3}{8} = 2.375$
0	7

Feature	Where
Domain (x interval)	$(-\infty, \infty)$
Range (y interval)	$(-\infty, \infty)$
Positive (x interval)	$(-2, \infty)$
Negative (x interval)	$(-\infty, -2)$
Increasing (x interval)	$(-\infty, \infty)$
Decreasing (x interval)	$\emptyset$
Asymptote(s) (line equations)	$\emptyset$
Intercept(s) (coordinates)	$(-2, 0)$ and $(0, 7)$

5

6. Make an accurate graph, and describe locations of the features (using interval notation, line equations, and Cartesian coordinates).

parent: $b = \frac{1}{a}$

HA @ $b=0$

VA @ $a=0$
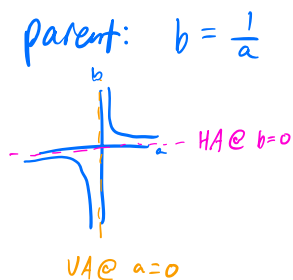
a	b
-2	$-\frac{1}{2}$
-1	-1
$-\frac{1}{2}$	-2
$\frac{1}{2}$	2
1	1
2	$\frac{1}{2}$

$$y = \frac{1}{3-x} - 1$$

$3 - x = a$
$-x = a - 3$
$x = -a + 3$
$x = 3 - a$

$y = \frac{1}{a} - 1$
$y = b - 1$

if $b = 0$
$y = -1$
HA @ $y = -1$

a	b	x	y
-1	-1	4	-2
1	1	2	0

if $a = 0$
$x = 3$
VA @ $x = 3$
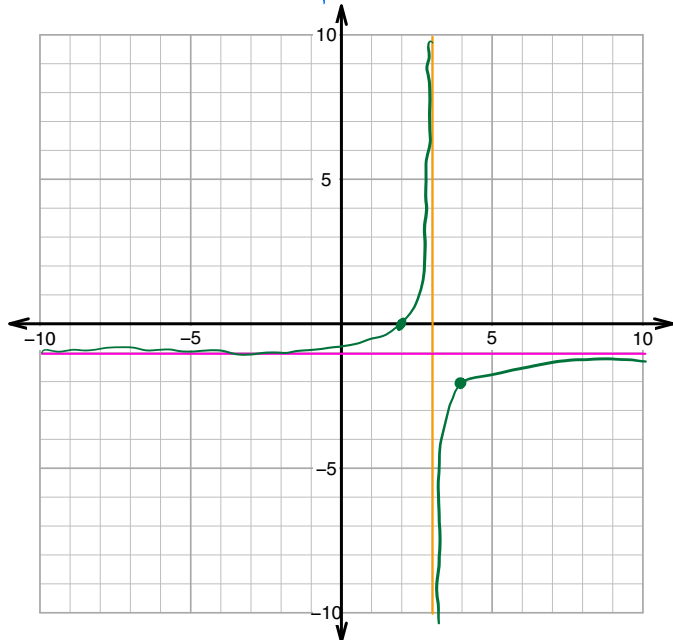
Feature	Where
Domain (x interval)	$(-\infty, 3) \cup (3, \infty)$
Range (y interval)	$(-\infty, -1) \cup (-1, \infty)$
Positive (x interval)	$(2, 3)$
Negative (x interval)	$(-\infty, 2) \cup (3, \infty)$
Increasing (x interval)	$(-\infty, 3) \cup (3, \infty)$
Decreasing (x interval)	$\varnothing$
Asymptote(s) (line equations)	$x = 3$ and $y = -1$
Intercept(s) (coordinates)	$(2, 0)$